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Pastoralism Under Pressure: Tracking System Change in Southern Ethiopia

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While economic development has proven elusive in African pastoral systems, change is pervasive. The majority of the Kajiado Maasai, for example, have endured marked declines in per capita livestock holdings and other aspects of human welfare over the past 50 years. We surveyed 317 Borana households to see if similar patterns occurred in southern Ethiopia, and our predictions were largely confirmed. Once viewed as the epitome of sustainable pastoralism, the Borana system now confronts numerous challenges. Decline in per capita cattle holdings has spurred household-level diversification to include maize cultivation and camel husbandry in some areas. Resource pressure has encouraged local annexation of some formerly common access grazing areas. Economic links between pastoral households and local towns still appear rare, however. Our results suggest that patterns of internally induced socioeconomic change due to population pressure in such semiarid systems are broadly predictable, and that development intervention priorities should reflect system dynamics and address emerging issues. A focus on improving risk management by facilitating household economic diversification and restoring some aspects of opportunistic resource use may be the most appropriate development options among the Ethiopian Boran at this time.

KEY WORDS: Boran; drought; risk management; pastoral development.

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INTRODUCTION

The pastoral peoples of arid and semiarid Africa primarily raise livestock to produce milk for household consumption. These livestock also provide a means for wealth accumulation, meat production, and cultural expression. Attempts to "develop" African pastoral systems with western production models and infrastructure have typically failed over the past 40 years for various (sound) reasons (Behnke, 1983; Coppock, 1994; Jahnke, 1982). Lack of impact from economic development, however, should not imply that pastoral systems do not change—indeed, change is pervasive. The Maasai of semiarid Kajiado district in Kenya are perhaps the most thoroughly documented pastoral group in East Africa (Bekure *et al.*, 1991; Campbell, 1999; Coast, 2002; Evangelou, 1984; Fratkin, 1994; Galaty, 1994, 1992; Homewood, 1992; Kimani and Pickard, 1998; Meadows and White, 1979; Rutten, 1992; Thompson and Homewood, 2002; White and Meadows, 1981; Zaal, 1999). The overall pattern of change for the Kajiado Maasai pastoralists over the past 50 or more years can be simplified and summarized as consisting of (1) a decline in the ratio of cattle to people, largely a result of periodic limits on animal numbers imposed by natural resources and combined with a steady increase in the human population; (2) the need for people to then seek food sources to augment a declining per capita supply of cow milk, creating pockets of agropastoralism, wage employment, and increased market participation to facilitate exchange of livestock products (including insufficient milk supplies) for more calories as cereal grains; (3) increased internal pressure to control or privatize resources as resource competition is intensified; (4) loss of key grazing or water resources to land annexation or ecological degradation; (5) shifts for households to keep more small ruminants (relative to cattle) as the forage base is altered, people become more sedentary, and women assume larger managerial roles as a result of men seeking outside employment; and, with some exceptions, (6) a specter of increased poverty and food insecurity, especially for the poorer segments of the population when links to other economic sectors are tenuous. The ultimate internal driving variable for this sequence is human population growth (Boserup, 1980), and this is often manifested in pastoral zones when people have limited opportunities for emigration. Local population and resource factors serve to filter or mediate effects from national and international phenomena that drive markets for critical variables such as livestock and land (Campbell, 1999; Evangelou, 1984; Rutten, 1992; Toulmin and Quan, 2000). Livestock dynamics often resemble a "boom and bust" cycle of herd growth followed by a sudden crash when a dry or drought year coincides with a period of high stocking rates (Bekure *et al.*, 1991; Meadows and White, 1979; Rutten, 1992). Unless relieved by substantial emigration

outlets or production technology, these features all contribute to create a pressurized, increasingly competitive situation where increasing numbers of pastoralists are periodically ejected out of the system (Hogg, 1980). This can set the stage for people remaining in the system to seek ways to diversify household economies to better manage economic and ecological risk (Campbell, 1999; Coast, 2002; Little *et al.*, 2001; Rutten, 1992).

In a synthesis of trends for the semiarid Borana pastoral system of southern Ethiopia from 1959 to 1991, Coppock (1994) theorized that the general situation for the Boran was much like that for the Kajiado Maasai, except that the Boran were a few decades "behind" the Maasai in terms of the time line. In other words, what internal changes the Maasai had undergone in the 1960s seemed evident in southern Ethiopia by the 1980s. For example, by the late 1980s the Ethiopian Boran appeared to be in a vicious cycle of cattle mortality due to an interaction between drought and high stocking rates (Coppock, 1994; Desta and Coppock, 2002), women were often selling dairy products from a milk-deficit situation (Holden and Coppock, 1992), and land parcels were being annexed from common access grazing for use in grain cultivation and as forage reserves by both influential individual Boran and local communities (Atsedu, 1990; Coppock, 1994). In the context of follow-up work among the Ethiopian Boran focused on cattle herd dynamics and asset diversification (Desta, 1999; Desta and Coppock, 2002), we decided to devote effort to track some empirical features and pastoral perceptions of system change and examine predictions loosely based on the "Maasai model" mentioned earlier. Although a Maasai model is a gross oversimplification of a very complex situation, the impressive documentation of recent history among the Kajiado Maasai provides a very useful template for theory refinement and comparative analysis. Among the pastoral segment of Borana society, therefore, we expected to see trends such as (1) declines in the ratio between cattle and people; (2) increased household emphasis on food-crop cultivation and livestock diversification; (3) increased food insecurity, and (4) decreased access to grazing land. If internal system dynamics were found to be somewhat predictable, this could have important implications for pastoral research and development priorities in the region.

METHODS

Study Area Description

Research was conducted on the Borana Plateau (95,000 km^2) in the western half of the Southern Rangelands Development Unit (SORDU)

near the Kenyan border. Elevation varies from 1000 to 1500 m in the southeast and the north, respectively. The region is bisected by a tarmac road that runs north to south and connects the border town of Moyale with the Ethiopian capital (Addis Ababa) in the highlands. The climate is largely semiarid with relatively cool annual temperatures (19–24°C) and a mean annual rainfall ranging from 400 to 600 mm that is bimodally distributed [60% during April to May (long rains) and 30% during October to November (short rains)]. A cool dry season occurs from June to September, while a warm dry season occurs from December to March. Vegetation is comprised of a mixed, perennial savanna characteristic of East Africa. The dominant ethnic group is the Boran who number around 325,000 and herd over one million head of cattle along with smaller numbers of sheep, goats, camels, and equines (CSA, 1996; Desta, 1988; Helland, 1997). Cattle may range widely in search of grazing and water during dry seasons and drought, but households appear to be increasingly sedentary and reside in encampments or villages in the vicinity of towns and markets. Resource use in the core area of the central plateau is based on the traditional *madda* system where communities are organized with respect to permanent systems of deep wells and their associated grazing. High labor requirements to operate the wells have led to an unusual degree of social cohesion and cooperation regarding resource use. Productivity of forage and livestock is seasonally dynamic, with flushes of primary and secondary production associated with rainy periods. Dry periods, in contrast, are times when green forage and drinking water become more scarce, animals lose weight, and people can reduce food intake. More details concerning the description of the study area are available elsewhere (Coppock, 1994; Cossins and Upton, 1987; Desta and Coppock, 2002; Holden *et al.*, 1991; Holden and Coppock, 1992).

Study Site Selection

The target population for this study comprised about 7000 pastoral households residing within a 35-km radius of the towns of Arero, Mega, Negele, and Yabello in the north-central region of the plateau during 1996–97. Population sizes for the towns ranged from 4100 (Arero) to 5240 (Mega), 10,300 (Yabello), and 25,000 (Negele), based on data from CSA (1996). The distance between towns varied from about 50 km (Yabello to Arero) to 100 km (Mega to Negele). The cumulative 15,500-km^2 area that was selected represented 16% of the Borana Plateau in terms of size and contained about 15% of the total pastoral population (CSA, 1996; Desta, 1999). These four town-based sampling areas are henceforth referred to as study sites.

Study sites varied with respect to rainfall and natural resource management. The Negele and Arero sites tend to have higher rainfall compared to Yabello and Mega. Natural resource use is also less controlled in Negele and Arero compared to that for Yabello and Mega (Desta, 1999). Traditional forms of grazing control based on access to water in the permanent deep-well system (earlier) prevailed around Yabello and Mega. In contrast, access to water around Negele and Arero focused more on use of ephemeral wells and seasonal surface flows, and thus grazing control there was more loosely structured.

Sampling

The sample unit was the household consisting of people dependent upon family-owned livestock for their sustenance. A sampling frame for the target population was created by listing all pastoral households across the four study sites—this alone took 6 months because an official census was unavailable. Key informants were then used to stratify households by wealth class based on modal ratios of cattle per person (Assefa, 1990; Grandin, 1988). Modal ratios ranged from about 14:1, 6:1, and 2:1 for wealthier, middle class, and poorer households, respectively (Desta, 1999); this categorization was in general agreement with previous empirical assessments (Coppock, 1994). A final sample of 336 households, or 4.7% of the target population, was selected for survey. Each study site ended up with 84 households for our work. Wealth classes were sampled proportionally to their occurrence. Wealthier, middle-class, and poorer households in the sample totaled 24, 124, and 188, respectively. This reflected that 7%, 37%, and 56% of households were wealthy, middle class, or poor in the sampling frame (Desta, 1999). The sampling design was thus stratified random. Finally, we wanted to sample only "viable" pastoral households, and thus we did not consider stockless pastoralists or other nonpastoral households in our sampling frame. This resulted in our study sites being "doughnut-shaped" with urban and periurban subpopulations omitted in the center.

Data Collection and Analysis

Results reported here were obtained using two surveys implemented over a period of about 18 months. One survey was broader and more superficial in terms of data collection—this involved the 336 households. The other survey was narrowly focused with more detail and required follow-up visits with a subsample of 60 households. Households in the subsample

were also blocked by site, but stratified evenly by wealth class. Both surveys typically relied on group interviews of extended families.

The objective of the broader survey was to get a picture of how the people perceived the state of their production system and lives at the present time. It included questions pertaining to the composition of households, trends in the standard of living, livestock resources owned, involvement in cultivation, sources of income, management practices for livestock and natural resource management, perceived socioeconomic trends, and degree of confidence in the future. This survey took 2 to 3 h to complete per household.

The main objective of the detailed survey was to quantify how cattle holdings had changed over the period 1980–97. Cattle are the dominant species in the area and the species most valued by the Boran (Coppock, 1994). We expected a declining trend for cattle holdings per household and a cycle of growth in numbers followed by sharp drops due to rainfall deficits—essentially a "boom and bust" cycle. These interviews took up to 2 days to complete for each household. Families were asked to form consensus and recall herd histories going from 1997 backwards in a stepwise fashion to 1980. The 17-year period was needed to have a sufficient time to capture droughts in 1984–85 and the early 1990s. The Borana traditional calendar (Legesse, 1973) was used along with known benchmark years for droughts and other ecological, social, political, and cultural phenomena. Annual estimates of the household herd size, recruitment, mortality rates, and other transactions were obtained. Such approaches have been shown to be effective with African pastoralists because they have well-developed mental skills to track cattle inventories (Assefa, 1990; Ensminger, 1992). We had no other option but to rely on recall methods for this information. See Desta (1999) for details on his herd history methodology.

Data were typically analyzed using descriptive statistics such as 95% confidence intervals (CI). This was employed to contrast household resources in 1996–97 with previous findings reported in Coppock (1994), Assefa (1990), or Desta (1988). Pearson's chi-square was used to assess effects of wealth class and formal education on economic diversification of households. A person was considered as having received formal education if he or she attended school through at least the second grade (Desta, 1999).

RESULTS

We were successful in interviewing nearly all households in our sampling frame. For both surveys about 95% of designated households participated. Out of 7007 households comprising the target population, over half

Table I. Target Population for Four Study Sites on the North-Central Borana Plateau as Distinguished According to Wealth Class and Gender

	Wealth class			
Gender	Wealthy	Middle class	Poor	Total
Male	495	2460	3151	6106
Female	15	145	741	901
Total	510	2605	3892	7007

Note. Here wealth class was based on the ratio of cattle/people in each household. Wealthy, middle class, and poor households had cattle/people ratios of 14:1, 6:1, and 2:1, respectively (Desta, 1999). Gender refers to male versus female heads of households.

were in our poor economic class (Table I). About 13% of household heads were female, while over 8 of 10 female household heads were categorized as poor (Table I).

Cattle dynamics for 17 years as reported by survey respondents exhibited a downward trend in cattle holdings per household and, indeed, a boom and bust pattern reflected major losses in 1984–85 and the early 1990s (Fig. 1). On average, households reportedly lost 67 head of cattle to drought-related mortality over 17 years, largely due to starvation (Fig. 1; Desta, 1999). Death losses were 10 to 15 times greater than net sales, indicating that natural factors, not marketing, regulated the population size (Desta, 1999). Households sold an average of only one to four head of

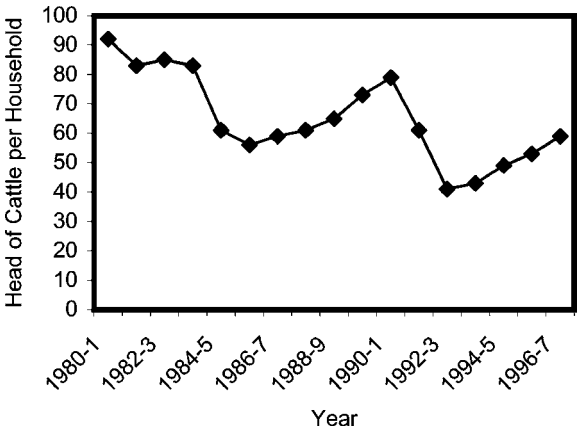

Fig. 1. Average cattle holdings for 56 Borana households during 1980–97 as compiled from herd-history interviews based on recall (Source: Desta, 1999).

Table II. Population Data for Cattle and People from the North-Central Borana Plateau

Parameter	Time period		Reference
	1996-97	Previous	
Persons per household			
Wealthy	10.2 ± 2.0 (a)	6.4 ± 0.4 (b)	Assefa (1990)
Middle class	8.3 ± 0.6 (a)	4.8 ± 0.4 (b)	Assefa (1990)
Poor	6.5 ± 0.4 (a)	5.6 ± 0.4 (a)	Assefa (1990)
All	7.4 ± 0.3 (a)	5.5 ± 0.4 (b)	Assefa (1990)
Cattle per household			
Wealthy	129 ± 50 (a)	91 ± 28 (a)	Assefa (1990)
Middle class	42 ± 12 (a)	35 ± 14 (a)	Assefa (1990)
Poor	16 ± 06 (a)	13 ± 06 (a)	Assefa (1990)
All	34 ± 10 (a)	34 ± 14 (a)	Assefa (1990)
Cattle per person			
Wealthy	12.8:1	14.2:1	Assefa (1990)
Middle class	6.1:1	7.3:1	Assefa (1990)
Poor	2.5:1	2.3:1	Assefa (1990)
All	5.0:1	6.2:1	Assefa (1990)
Cattle			
Female/male	71:29	71:29	Coppock (1994)
Mature cows(%)	38	45	Desta (1988)
Households			
Wealthy(%)	07	18	Assefa (1990)
Middle class(%)	37	31	Assefa (1990)
Poor(%)	56	51	Assefa (1990)

Note. Statistics include 95% confidence intervals. Entries in the same row accompanied by the same letter (a,b) were not significantly different at $P < 0.05$. Ratios and percentage results were not compared statistically. Data from Assefa (1990) were collected in 1988 and were based on $n = 633$ pastoral households. Data from Coppock (1994) were synthesized from several household and water-point surveys in the late 1980s. Data from this study in 1996-97 were based on $n = 317$ pastoral households. All households from Assefa (1990) and Coppock (1994) were located in the same general area as the households surveyed for this paper. Statistics denoted for "All" were based on weighted averages that incorporated the proportion of various wealth classes in each population over time. Data for herd composition in Desta (1988) were based on a regional census.

cattle per year according to wealth class (Desta, 1999). The overall net loss of cattle between 1980 and 1997 was 34 head per household, or 37% (Fig. 1). The net loss in cattle inventory for poor households was about 60%, while that for middle-class and wealthy households was around 25% (Desta, 1999).

Table II illustrates comparisons among population data for cattle and people collected in 1996–97 with that of previous studies. Previous studies cited in Table II sampled the same general target population, but not necessarily the same households. We therefore expect that different surveys captured different arrays of households. Households in previous studies were defined in a similar manner as in this investigation.

Table III. Recent Shifts in Wealth Status as Reported by 317 Borana Households

	Past wealth status		
Current wealth status	Wealthy	Middle class	Poor
Wealthy	22	1	1
Middle class	56	58	18
Poor	29	73	59

Note. Here wealthy households had a ratio of cattle to people of around 14:1, middle class households had a ratio of around 6:1, and poor households had a ratio of around 2:1 (Desta, 1999). Shift in wealth status was with regards to the past 5 to 10 years.

Patterns in Table II indicate that the number of people per household significantly increased ($P < 0.05$) between 1988 and 1996–97 by 60% (wealthy), 73% (middle-class), and 36% (overall). Only the poor showed no trend in this regard. The number of cattle per household in 1996–97 was statistically similar to past estimates for all categories, and these numbers were highly variable. The number of cattle per person decreased by 19% overall, however, and this occurred mostly as a result of declines in herd sizes for the wealthy (Table II). Herd structure for cattle appeared to change little between 1987–91 and 1996–97. The percentage of households that were ranked as wealthy in 1996–97, however, was about one third of the figure for 1988 (Table II).

One outcome of a decline in cattle numbers per capita is decreasing wealth. Data in Table III indicate that most survey respondents perceived they were becoming poorer. Almost 50% of households reported a decline in wealth status in recent times, while only 7% reported an increase.

Perceptions of system trends among herd owners are shown in Table IV. The overall view strongly supported the idea that availability of grazing land had declined as had quantity of milk for people and calves. Standard of living reportedly had dropped for a slight majority of households. High proportions of herd owners perceived that the need for pastoralists to sell dairy products had increased, growth in the size of the human population had occurred, the need for cash income had increased, and that there was a heightened availability of, and demand for, cereal grains for human consumption. Opinions regarding production trends for livestock species were more mixed, however. Production of small ruminants was generally thought to be in decline, while camel holdings were perceived to be increasing (Table IV). Despite periodic reductions in the regional cattle herd on a per household basis (Fig. 1), survey respondents tended to feel that the overall number of cattle had actually increased over the longer term. Improvement in cattle health from veterinary interventions was a primary reason given for this pattern (Desta, 1999).

Table IV. Trends in the Borana Pastoral System as Perceived by 317 Herdowners

Feature	Perceived trend (% who agreed)		
	Decreasing	Increasing	No change
Access to grazing land	91	7	2
Milk for people	97	1	2
Milk for calves	97	1	2
Standard of living	55	11	32
Grain in markets	22	76	0
Pastoral grain consumption	1	99	0
Pastoral dairy sales	29	71	0
Human population	0	98	0
Need for cash income	0	99	1
Cattle production	24	74	2
Sheep production	74	24	2
Goat production	59	38	3
Camel production	14	84	2

Note. Some rows may not add to 100%, and this is due to some respondents having "no opinion." Seventy-five percent of respondents felt that a gradual privatization of key lands due to creation of fodder reserves and cultivation, and increasing restrictions in access to the deep wells for poorer households, was reducing mobility of livestock herds (Desta, 1999).

Ranked income sources for 56 households are shown in Table V. Livestock, as the traditional source of income, remained dominant, although nontraditional agricultural activities such as sales of dairy products and home-grown grains were also commonly mentioned. Nonpastoral or nonagricultural income sources were rare and dominated by mining and wage labor. In general, economic links of pastoralists to town-based economies seemed very limited. Reported income from remittances was virtually nil.

Table V. Ranked Sources of Income for 56 Pastoral Households on the North-Central Borana Plateau, 1996–97[a]

Rank	Income source[b]						
	Livestock	Dairy	Wages	Grain	Gold	Salt	Other
1	43	0	2	2	1	1	5
2	4	13	1	5	6	3	4
3	3	4	3	6	1	2	0
4	0	7	1	2	0	0	0

[a]Failure of some rows to add to 56 indicates "no opinion" or missing data (Desta, 1999).

[b]Where "grain" implies home-grown cereals (largely maize) that was sold. Gold was typically mined from sites to the north, while salt was mined from volcanic craters to the south. "Other" income sources included cattle trading, gum collection, small-scale entrepreneurial activities in towns, etc. (Desta, 1999).

The most common form of activity diversification away from traditional livestock production involved cultivation. We found that 67% of 311 households were routinely cultivating with significant variation in the percentage of households cultivating due to study site (Desta, 1999). Pearson's chi-square test revealed that a higher proportion (74%) of wealthy and middle-class households was cultivating, compared to 61% of poorer households ($P < 0.05$, $\chi^2 = 5.9$, df = 2). The average plot size (±SE) per household was 1.8 ± 0.2 ha (Desta, 1999). Less than 1% of the Borana Plateau was estimated to be under cultivation by 1997, and this may translate to around 5% of potentially arable land (Coppock, 1994; Desta, 1999).

Only 57 of 317 households (18%) had members with any formal education. The rate of illiteracy per capita was 92%. Households with members having formal education were positively associated with economic diversification outside of traditional livestock production ($P < 0.01$, $\chi^2 = 7.7$, df = 1). The association was stronger, however, for economic diversification beyond livestock and crop production ($P < 0.001$, $\chi^2 = 5.8$, df = 1).

DISCUSSION AND CONCLUSIONS

Pastoral systems are dynamic. The cyclic nature of livestock populations here and other sources of annual variability make interpretation of results from any single survey problematic. Most of our findings were also based on the perceptions of survey respondents, and these can be subject to error. Bias occurring from reliance on long-term recall and "favorable recollections of the past" can be a common problem in such surveys. Unfortunately, detailed studies of pastoral dropouts and the wage labor arena were also beyond the scope of our efforts, and should be priorities for future study. We are aware, in general, that pastoral dropouts seem to move to periurban or urban locales and engage in cultivation, charcoal sales, and similar activities. We know little else about them, however, and hence the need for more work. Despite these and other limitations, we still feel we are piecing together a useful picture of system change here.

Several major aspects of the Maasai model were supported in this analysis. They included confirmation of (1) a "boom and bust" pattern of cattle population dynamics, likely shaped and amplified by a loss of key grazing resources; (2) a decline in per capita cattle holdings and wealth status; and (3) heightened food insecurity, with people attempting to offset a decline in milk supplies by becoming more involved in cultivation and local markets. We acknowledge that in some cases the evidence is stronger (cattle dynamics; change in cattle/person ratios, incidence of cultivation, dairy sales, and camels), while in other cases evidence is weaker (change in living

standards, food insecurity). All of these perspectives, however, have been independently echoed in other recent documentation regarding perceptions of the Borana leadership concerning important social and natural resource issues in southern Ethiopia. General assemblies of the Boran are called *Gumii Gaayo*. Prominent themes are discussed and debated at these assemblies, with attendance typically in the thousands. The *Gumii Gaayo* has been held once every 8 years since 1696 (Legesse, 1973). At the 37th *Gumii Gaayo* held in 1996, the leadership acknowledged the declining welfare of the Borana society in general and confirmed the increasing dependence of pastoralists on towns, markets, and farming for survival (Huqqaa, n.d.).

Our household-level data lead us to speculate that declines in food security and wealth among the Boran appear more attributable to an increase in the human population rather than an absolute drop in cattle numbers per se. Views of the Borana leadership at the 37th *Gumii Gaayo* also support the perception of our survey respondents that the cattle population has actually increased. The "cattle problem," as viewed by *Gumii Gaayo* leaders, is seen as a reduced productivity per head due to high stocking rates and environmental degradation (Huqqaa, n.d.). According to documentation from the *Gumii Gaayo*, growth in the cattle population in recent years is attributed to more effective veterinary interventions, a relative lack of markets, and persistence of conservative behavior among herd owners that favors livestock accumulation (Huqqaa, n.d.).

Despite our contention that the human population has increased, it is not possible to confirm this without detailed census figures. We also cannot estimate growth from our data given we do not know if numbers of households have changed over time. Research by B. Lindtjørn (Univ. Bergen, unpublished data) in the late 1980s estimated the rate of growth for the Borana pastoral population to be 2.5% per annum, while the CSA (1996) used a growth rate of 2.2 % per annum in their projections. Assuming these figures are accurate, such growth rates would result in a doubling time of about 30 years for the local population. We see lack of emigration options as the main problem spurring growth in pastoral populations in southern Ethiopia, and this is most likely due to lack of rural education and underdevelopment of other economic sectors. This lack of emigration options remains as an untested hypothesis, however (Coppock, 1994).

Besides human population growth, the next most important factor contributing to reduced productivity and heightened food insecurity here may indeed be loss of key resources, fall-back grazing reserves, and environmental degradation. The Boran reportedly have been increasingly hemmed in by other ethnic groups at their territorial margins in recent years. This has been exacerbated by government initiatives that have reallocated critical grazing and water resources from the Boran to Somali interests along an

eastern frontier near Negele (Desta, 1999; Huqqaa, n.d.). The Boran have also lost northern territory to the Guji (Desta, 1999). This has probably led to a greater concentration of livestock in the central Borana Plateau. This external stress has created more internal pressure as satellite (*forra*) herds increasingly trespass on grazing areas (*arda*) reserved for home-based (*warra*) herds according to reports from respondents in Desta (1999). The resulting heavy concentration of grazing has, in turn, contributed to bush encroachment with detrimental effects on production of herbaceous forage. An official ban on prescribed fire since 1974 has also encouraged bush encroachment given that regular fire can suppress establishment of young woody plants (Coppock, 1994; Huqqaa, n.d.). Local regulation of resource use is also being compromised. This has primarily occurred as a recent, state-level administration has usurped traditional authority in many cases (Desta, 1999; Huqqaa, n.d.; Moris, 1999).

Cultivation started to become widespread on the central Borana Plateau after the 1983–84 drought as people opportunistically planted maize and cowpea (*Vigna* sp.) to deal with food gaps created by massive cattle mortality, especially for vulnerable milking cows. As recently as the 1960s, few pastoral Boran regularly cultivated (Legesse, 1973). It could be expected that cultivation would predominate among the poorer rather than wealthier households simply because the poorer households have fewer livestock per capita and less ability to purchase food (Hogg, 1986). We found in our current effort, however, that wealthier and middle-class households were also heavily engaged in cultivation as they attempted to mitigate pressure to sell their livestock to buy grain (Desta, 1999). This pattern has been observed elsewhere (Little, 1985). Independent confirmation of the increasing importance of cultivation to Borana society is again provided by Huqqaa (n.d.). He noted that the Borana leadership felt that locally grown cereals had become "indispensable" in human diets and that a "farming economy must be encouraged" in areas with suitable rainfall. It would therefore seem that in certain locales a transformation of pastoralism to agropastoralism is being driven by an increase in the human population and decrease in the number of cattle per person. Mace (1993), in a study using a dynamic optimality model of herding and farming as long-term survival strategies, investigated under what circumstances people might shift from herding to farming and vice versa. She concluded that declines in pastoral household wealth can favor a shift from pastoralism to agropastoralism.

Cultivation helps diversify sources of food and income for pastoralists during some nondrought years, as roughly 3 of 5 nondrought years are anticipated to have sufficient rainfall to produce a crop (Desta, 1999). Cultivation has mixed attributes with regards to augmenting drought coping strategies. On one hand, cultivation can undermine drought coping strategies

because cultivated area usurps key grazing areas and, of course, yields little or no food when rainfall is low. Cultivation can be vital, however, in helping a population quickly mitigate hunger once rainfall returns, especially given the slow recovery of milk production (Coppock, 1994). Hogg (1980) found that Boran residing in northern Kenya were better able to withstand decimation of livestock herds if they were involved in farming. Similar perspectives for the Maasai have been forwarded by Campbell (1999). Coast (2002) noted in her surveys that 45% of Maasai households were actively cultivating. This figure is about two thirds of that revealed for the Boran, in our work.

Internal annexation of communal grazing land for cultivation plots and calf forage reserves by local communities and individuals began in earnest on the central Borana Plateau during the 1980s, although it was initiated on a small scale some 20 years earlier (Atsedu, 1990; Coppock, 1994). Parcels are protected by bush-fencing or merely decree and range from 1 to 80 ha in size, with an average size of 12 ha (Atsedu, 1990). Local land annexation has been a common response to chronic grazing pressure and heightened uncertainty of resource access in Kajiado Maasailand and elsewhere (see review in Coppock, 1994; Bekure *et al.*, 1991). Our work indicated that by the late 1990s internal land annexation by Boran for grazing and farming and restrictions in access to deep wells were all seen as pervasive threats by a majority of survey respondents. Again, the greatest fear among the Boran was how such controls could limit herd mobility during times of stress (Desta, 1999). Ensminger (1990) also noted similar trends among Orma pastoralists in Kenya. Population pressure, shrinkage of resources, and lack of opportunity for territorial expansion forced the Orma to restructure internal property rights in favor of privatization.

Kimani and Pickard (1998), Galaty (1994, 1992), and Rutten (1992) have documented a high degree of resource annexation and fragmentation in the Kajiado Maasai system as a result of various privatization initiatives during the 1980s and 1990s. This prominently includes outside groups as well as Maasai, however, and illustrates how national policy factors and close proximity to major metropolitan centers (like Nairobi) strongly affect resource tenure and land markets (Campbell, 1999; Rutten, 1992; Toulmin and Quan, 2000). Resource fragmentation can rapidly undermine the ecological and economic basis of extensive, rangeland production systems (Galaty 1994, 1992; Kimani and Pickard, 1998). The role of outside agents in land annexation is still minor in the southern Ethiopian rangelands—in this respect, the relatively remote location of the Borana Plateau from the highlands and large cities is likely fortuitous. While a steady stream of highland farmers began to cultivate higher potential locations in the vicinity of small towns on the Borana Plateau some 50 years ago, this flow subsided by

the 1980s (Coppock, 1994; Desta, personal observation). The major external threat from land annexation for cultivation today comes from expansion of periurban fields held by local town dwellers. Efforts to grow more grain are generally seen as positive by local administrators, however, who have a short-term view of development needs and consequences. Farmers thus have more political clout than pastoralists with decision makers, and this is typical for such situations (Coppock *et al.*, 2002).

Despite a general congruence of internally driven change in the Borana system with major aspects of the Maasai model, the picture gets much more fuzzy with regards to "details" such as possible shifts in livestock species composition, cattle herd structure, or degree of economic diversification for households. Lack of agreement in such details may simply occur because of problems with data quantity, data quality, and/or system variability due to unique aspects of location, national policy factors, and time frame. The Maasai model suggests that households will shift their emphasis to include more small ruminants as resource constraints change and market involvement increases. The pattern among the Boran concerning perceived shifts in livestock species composition, however, was in terms of camels and cattle increasing and small ruminants decreasing. There is some other evidence that verifies an increase in camels held by the Boran. Coppock and Mamo (1985) surveyed 60 Boran encampments encompassing some 1200 households in the same general area as the work reported here. They estimated about one camel for every 10 households at that time. In contrast, Desta (1999) estimated 1.7 camels per household from his sample of 336 respondents, suggesting a major increase over 12 years. We therefore believe the increase in camels is real in this portion of the plateau and reflects a purposeful strategy by many Boran to incorporate more camels to diversify their holdings of large livestock. This shift is likely in response to woody encroachment that benefits browsing camels over cattle, and contributions that camels make to increased milk production for home consumption and sale during drought—camels are also useful for hauling grain and water far from settlements (Coppock, 1994). The large increase in camel numbers over a relatively short period of time, however, is more likely due to the Boran raiding neighboring groups such as the camel-keeping Gabra, rather than natural recruitment. Conflict between the Boran and Gabra escalated sharply during a brief period of insecurity when the previous Ethiopian regime was overthrown in 1991 (Coppock, 1994; Huqquaa, n.d.). While the Maasai system has never included camels as a significant component, this is likely because Maasailand, unlike the Borana Plateau, is not in close proximity to other camel-keeping peoples. Incorporation of camels into livestock herds has also been observed among the East Pokot in Kenya (Bollig, 1992).

In contrast to camels, we see little supporting long-term evidence of substantive change in the relative sizes of cattle or small ruminant populations during the past decade. Reda (2001) summarizes data collected for several hundred Borana households by nongovernmental and bilateral governmental organizations in our study area. His data indicate that camels have increased 75% from 2 to 3.5 head per household between 1994 and 2000, while the average number of goats increased 11% (from 5.7 to 6.3 head), sheep decreased 35% (from 6.2 to 4.0 head), and cattle decreased 17% (from 14.0 to 11.6 head). One potential problem with these data, however, is the relatively short time frame of analysis. Contrasts of livestock composition from aerial survey data from predrought 1982 [Eshete *et al.* (1987) summarized in Coppock (1994)] with aggregated survey data from Desta (1999) suggest that the cattle population has remained at 73–74% of total livestock on a numerical basis, with small ruminants steady at 21–23%. Camels, however, increased from 2% (1982) to 4% (1997). Although such data comparisons are problematic, they are all we have at our disposal. We feel, in contrast to camels, that there is thus no compelling evidence to support a relative change in abundance for cattle or small ruminants here in recent times.

Despite the equivocal nature of the sheep and goat data, many Boran households interviewed by Desta (1999) declared that one of their goals has been to increase small ruminant production. This response is consistent with the Maasai model. To reconcile these observations, we hypothesize that small ruminant production is probably markedly constrained on the relatively mesic, central Borana Plateau due to prevalence of virulent diseases such as contagious caprine pleuropneumonia (CCPP) and a pervasive lack of veterinary support systems for sheep and goats (Coppock, 1994). Mortality rates for young small stock as high as 32–45% have been observed in the north-central region (Coppock, 1994). In addition, we suspect that there are relatively few market opportunities on the remote Borana Plateau, and this is particularly relevant for goats (Coppock, 1994). The Kajiado Maasai, in contrast, have certainly benefited in this respect from their proximity to a major urban center like Nairobi in terms of having better access to reliable livestock markets and veterinary support systems (Bekure *et al.*, 1991; Evangelou, 1984; Rutten, 1992; Zaal, 1999).

We also observed little change in cattle herd structure between the late 1980s and late 1990s. The ratios of females to males stayed near 71:29, and the percentage of cows only ranged from 38 to 45%. Trends in cattle herd structure would be difficult to detect in any case because different age and sex classes are variously susceptible to drought mortality, and this introduces a large, time-sensitive source of data imprecision (Coppock, 1994).

We also did not document a convincing increase in the percentage of pastoral households regarded as "poor" despite prevailing views that the standard of living and level of wealth were declining in general. The percentage of households noted as poor in the late 1980s was 51%, and the figure was 56% in this study. We explain this apparent contradiction as a result of sampling bias—namely, our study focused on households that remained viable in the pastoral system and avoided those clustered around towns and settlements. The latter are typically comprised of people who have lost all or most of their animals and been ejected from the pastoral system (Coppock, 1994; Holden *et al.*, 1991). Had we tracked this subpopulation of stockless or former pastoralists associated with towns and farming areas, we speculate that the percentage of poor households would have indeed increased in the last decade.

Survey respondents commonly expressed a need for opportunities to diversify their economy, given pressures on traditional resources. Campbell (1999) noted that Maasai who had diversified into farming were better able to endure drought perturbation compared to those herders with a sole reliance on livestock. Our results revealed that diversification was most typically expressed in the form of increased involvement in cereal cultivation and camel husbandry—we surmise that a specter of food insecurity is the primary driver for this pattern. There were few apparent economic links between pastoralists and neighboring towns, however, such as regular wage labor, involvement in small businesses, etc. Compared to Kenya, this may be attributable to a generally lower level of economic development in rural Ethiopia and a much less educated pastoral population (Little *et al.*, 2001). We found exposure to formal education to be positively associated with nonagrarian economic diversification of households. Degree of formal education has been shown elsewhere to positively influence the success of rural extension programs (Phiri, 1998). In recent political decrees, the Boran have voiced support for pursuing more education for male and female youths and noted that the health of their pastoral economy increasingly depends on diversified linkages to towns and settlements (Huqqaa, n.d.). The *Gumii Gaayo* Assembly of 1996 resolved that "all economically well-off Booran [sic] get a piece of land in the urban areas and build living quarters and establish business enterprise in the urban centers . . ." In her recent surveys among the Maasai, Coast (2002) found that 32% of Kenyan Maasai aged 7–12 years attended school, while only 9% of Tanzanian Maasai did so. Although our data are not directly comparable, our surveys suggested a literacy rate of about 8% among the Ethiopian Boran. We therefore suspect that rate of school enrollment among the Ethiopian Boran is closer to that for the Tanzanian Maasai.

In summary, the general trajectory of the Ethiopian Borana system with respect to internally driven change conforms remarkably well to general patterns observed in Maasailand (and often elsewhere) in semiarid East Africa. Our observations validate the concept that increase in human population growth underlies internal changes in resource use, especially where avenues for alternative economic development are limited. This may, however, be unlike dynamics for the arid zone in East Africa where chaotic patterns of drought and limited alternative opportunities for sustainable agriculture obscure long-term system trends (Ellis and Swift, 1988). It is notable that livestock population dynamics, not human population dynamics, have been the focus of far more recent debate among ecologists and pastoral development practitioners in East Africa (Behnke and Scoones, 1993; Ellis and Swift, 1988). More analysis is warranted concerning how human population growth and distribution influence resource use and development opportunities.

The question now remains for the Boran and similar societies in the semiarid zone as to how development intervention might facilitate positive change when resource pressure becomes chronic, realistic options to reduce rates of human population growth are long-term at best, and appropriate technology and extension capacity are limited. We advocate a facilitating approach emphasizing self-help for communities, households, and individuals to better manage risk through economic diversification, a spontaneous trend observed throughout pastoral societies in East Africa (Little *et al.*, 2001). This is in recognition that coping strategies and development needs evolve as pastoral societies change (Campbell, 1999; Coppock, 1994; Fratkin, 1998; Rutten, 1992; Thompson and Homewood, 2002; Zaal, 1999). It also recognizes the high degree of variation on options imposed by local contingencies of spatial location, environment, gender, and wealth class (Smith *et al.*, 2001, 2000).

One model for the Borana Plateau could be to encourage some measure of asset diversification through more timely (i.e., precrisis) sales of livestock before droughts and other calamities, and investment of some of the proceeds in alternative endeavors to mitigate inevitable wealth losses (Coppock, 1994; Desta, 1999). These investments could include microenterprises, restoration of ecological resources, and support for social services in the absence of public funds (Coppock, 1994). Losses of livestock wealth to regular interactions of drought and high stocking rates is in the hundreds of millions of USD for the traditional, less-diversified Borana cattle system—an analysis reported in Desta and Coppock (2002)—so the scope for capturing lost wealth is vast. This strategy would require efforts to promote local-level savings and credit cooperatives (Ndofor, 1998), as regular use of banking facilities by the Boran is currently low (about 2% of survey respondents

had savings accounts), yet strongly affected by local access (Desta, 1999). Campbell (1999) reports shifts in increased use of banking by some Maasai as a drought coping strategy between the 1970s and 1990s. The high rates of illiteracy in rural southern Ethiopia need aggressive attention through improved access to formal and nonformal education to facilitate positive change; education could increase the chance that some Boran could leave the pastoral system, reduce resource pressure, and increase the possibility of future remittance income. This has been shown elsewhere in East Africa to be an important household coping tactic (Little *et al.*, 2001). The Boran also need improved access to livestock and grain markets (Bailey *et al.*, 1999; Coppock, 1994).

As elsewhere in Africa, Ethiopian pastoralists have long been marginalized in terms of being governed by effective policies (Hogg, 1997; Moris, 1999). Policy priorities have traditionally been focused on maintaining security, stimulating the supply of quality cattle for beef export markets, and some aspects of environmental conservation (see Introduction in Desta and Coppock, 2002). There are still policy gaps with regards to dealing with provision of education and other social services, expansion of cultivation, bush encroachment, or privatization of key resources. Increasingly, researchers and advocates for pastoralists will need to play a more interactive role with policymakers if improvements in these areas are to occur (Coppock *et al.*, 2002).

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